

*Remarks Prepared for Delivery*

# To Boldly Go

*Giving Thought to What Comes Next In Space*

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NATIONAL SPACE CLUB

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## *Giving Thought to What Comes Next In Space*

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I am particularly pleased to be with you today as we consider the outlook for space. I believe that outlook has gotten considerably brighter over the last couple of weeks. With President Clinton's decision to support a redesigned space station, one that will save the nation billions of dollars over the previous design, I believe we are prudently moving ahead with this important project.

The President in his statement last week said, "I instructed NASA to redesign the space station program in a way that would preserve its critical science and space research and ensure international cooperation -- but significantly reduce costs and improve management. NASA has met that challenge."

And we are ready to move ahead. We have a balanced program and a budget I am very proud of. We are fully supporting several major science programs, such as the two Advanced X-Ray Astrophysics Facility spacecraft, the Cassini probe to Saturn and Mission to Planet Earth. We are increasing our investment in aeronautics, one of the principal foundations for this country's technological strength.

And we are about to embark on an exciting new approach to planetary exploration through the Discovery series of space probes. These are low cost, relatively simple spacecraft that focus on specific goals. They aren't mega-spacecraft. They don't carry 12 or 15 science instruments, and they are simpler and cheaper to build and operate.

The idea is to build them, launch them, and get the data in three years or less.

Through this approach, we can literally fill the skies with our spacecraft, engage more and more scientists in the business of planetary exploration, and do these missions in about the same time it takes to get an advanced degree at a university.

So I want to stress today that NASA's plans for the future are about more than just the space station. There is a vision that encompasses the whole range of NASA's activities. This budget supports that vision, and we intend for science to thrive.

But the center of attention these days is the space station and it is indeed critical to the future of America's human space flight program. So I would like to spend some time this morning talking about the space station that has come out of our redesign process, and what it can do for America.

The President chose an option that will save an estimated \$18 billion over the projected 20-year lifetime of the program, with \$4 billion in savings over the next five years alone. He has called on NASA to economize, to continue with our management and procurement reforms, and to use very rigorous contracting methods to put the station program on a more business-like footing.

We think it is the right space station for the country. It is prudent, and it is responsive to the tight budget situation the country faces. But if we are going to do this right, we need a commitment. We need level funding. We need stability in this program, once and for all.

In return, it is fair to ask what the nation gets for its investment. One common criticism is that the redesigned space station cannot meet the original program objectives. But this is a new era, and a new station designed to meet the needs of changing priorities. Is it fair to hold the station hostage to objectives that are almost ten years old?

And in any event, this station can meet a variety of important objectives, such as meaningful science, advanced technology development, international cooperation, space leadership, national pride and exploration.

Consider the science, for example. Will the station provide meaningful science? Yes. Most of the disciplines we will study aboard the station require long-term exposure to the space environment. In studying the effects of weightlessness on the human body, for example, we require weeks and months aloft before all of the effects manifest themselves.

There is no guarantee of scientific payoff if we build a station. On the other hand, there is an absolute guarantee of finding nothing if we don't build one. Dr. Michael DeBakey, who testified before the House Subcommittee on Space yesterday, said, "We cannot always predict the outcome of scientific activity, especially efforts as broad and untried as space...We investigate to uncover questions we do not yet know how to ask, and to discover answers we never expected."

The fundamental property of a space station, one that cannot be reproduced in any way here on the Earth, is long-term exposure to space. Time aloft is the most precious resource that will come to us from the space station. That is why Dr. DeBakey is so supportive, because he knows our insight into the functioning of the human body will be expanded and enhanced through long-term access to space.

That is why Dr. Paul Chu, the foremost expert on superconductivity on this planet, is in support of a space station. High temperature superconductivity was discovered in the U.S. in 1987 and hailed as one of the most important scientific breakthroughs in decades. But the understanding of superconducting materials is limited by our ability to interpret the mechanisms that govern the ordering of atoms.

Those mechanisms are influenced by such phenomena as convection, sedimentation and buoyancy phenomena that are absent in the microgravity realm of space. We simply cannot turn our back on this fundamental window on the universe.

For thousands of years, the heat of a fire was the only process variable in the manufacture of new materials. Later we learned to use composition as a variable. During the Industrial Revolution, we added pressure as a variable in manufacturing. And now, through our long-term access to space, we can add the fourth and perhaps most important variable of all--absence of gravity. This can affect our understanding every manufacturing process on Earth. We must not turn away from these possibilities.

All that we have learned so far, in our painstaking, short trips to orbit, tells us there is much, much more potential out there. In the growth of protein crystals, we need weeks and months aloft to get the proper sizes for study. There are literally thousands of proteins and other biological substances that can benefit from being grown in space.

And the same is true on down the line. Biotechnology experiments on proteins, living cells, biological tissues and fluids, polysaccharides, nucleic acids, viruses, enzymes, seeds, plants and animals require microgravity conditions for 10 to 120 days. Materials processing experiments on various crystals, polymers, metals and fluids require microgravity for up to 60 days.

Will the station provide meaningful technology development? Yes. Critics sometimes say the station can't provide cutting-edge technology because human space flight requires tried and proven techniques and hardware to minimize risks to the astronauts. And in a very limited sense, this is true, but it ignores one of the fundamental facets of why we need a space station.

The growth of technology has always required a mix of theory and practice. Engineers think of things, build them, then try them out.

Then they fix their errors and try the hardware again. This pattern may be repeated many times before the engineer is satisfied.

Wind tunnels, for example, were first developed in the 19th Century, and the basic idea of suspending an airplane model in flowing air hasn't changed a great deal in the 100 years since. But using this tried and true technology, aeronautical engineers have transformed a series of fundamental unknowns into an elegant science. And there is much more to come.

The point is, we have provided our aeronautical engineers with the right tools to do the job. For the further development of space hardware and techniques, we also need the right tools to do the job. A research facility in orbit, operating under the actual conditions we need to learn more about, is one such essential tool.

Technology development doesn't just mean better microwave ovens or more compact computers. The station can help us learn about new structures and materials, power and thermal management, propulsion, fluids, telerobotics and information systems. In turn, this can lead to Earth-based applications such as light-weight oxygen tanks, high-strength, corrosion resistant pipes and vessels, long-life, self-healing paints and coatings, permanently lubricated motors and machines, and solar cells for home power generation.

The list is endless, but we can't even begin to make out the list unless we first get long-term access to space.

Will the station provide for international cooperation? Indeed it will. The redesign meets our commitments to our international partners. These commitments carry the status of treaty obligations, and we treat them very seriously.

Will the station give us leadership in space? Yes, I believe it will, but it is the kind of leadership that grows from trust among friends and partners on a frontier. It is the kind of leadership that comes from

keeping our promises. It is the kind of leadership that we would absolutely abdicate if we cancel the station. And leadership abandoned is leadership lost.

Will the space station give us educational opportunities? You bet. At this very moment, astronauts are circling the Earth in the Space Shuttle Endeavour, and as time allows they are using a Ham radio to contact school children here on the ground. When the President phoned the crew yesterday, he said, "I think sometimes we underestimate the impact that human contact in an enormously impressive setting like this can have on children all over the world, not only those with whom you'll talk, but millions of others who will just see it and know that it happened."

The station will give us the very same opportunities to inspire and educate young people, only more of them.

Will the station be source of national pride? I think the answer is yes. People will always dispute the polls that consistently show a high degree of support for the space program. But one thing you can't dispute is the number of people who pass through the turnstiles at the National Air and Space Museum in Washington, or Space Center Houston, or Spaceport USA at the Kennedy Space Center, or Space Camp in Alabama. Space is a part of our culture, a part of our mythology, some would say. And it is a very, very important part of our national character.

Claude Canizares, Director of the Center for Space Research at MIT, recently wrote, "If you dismiss this vision as mere puffery, try imagining that our present space program belongs to another industrial nation. What if we were bystanders, watching TV news reporting their shuttle launches and landings, their space telescope images of distant galaxies and quasars, their spacecraft pictures of Neptune or radar maps of Venus, their measurements of the ozone hole."

Finally, there is the prospect of continued exploration of the space frontier. Will this space station enable that? Of course it will. How in the world can we expect to truly evolve as a spacefaring power if we have only limited time in space? You can't learn to drive if you don't get behind a wheel. You can't become a pilot unless you are willing to do the solo. You can't excel at anything worth doing, as a matter of fact, unless you are willing to invest time and attention and more time and more attention to doing it right.

Space is the frontier of our age, and we can either grow and prosper on that frontier, or we can ignore it. But the frontier will still be there, and so will the promise of space. That is why the space station and the fate of the space program command so much time and attention, far more than their meager share of the vast Federal budget would at first suggest. It is because we are talking about our future here, about the legacy we will leave our children, and about a very visible symbol of America's willingness to remain a great and influential nation.

A society that does not dare to dream, a society that isn't willing to take risks, a society that has forgotten how to be bold, is a society in great peril, a society in decline. History has shown that the great nations have been those that had a spark of risk-taking, an eagerness for adventure and a capacity to operate at the frontiers of knowledge and exploration. We still yearn for that in this country.

So make no mistake. The debate over the space station is about more than nuts and bolts and blueprints. It is about more than a program. It is about the entire future direction of our human space flight enterprise. If the station is cancelled, then that enterprise will be at a technological dead end.

The Shuttle's viability will quickly be called into question, with no chance to move beyond our current state of capability. And I believe human space flight in this country will be in very, very big trouble. We risk the vengeance of history if the naysayers are able to force that choice upon the nation.



Somehow we have to move beyond the calculus for success which does not allow us to add in the intangibles. We don't know how to value faith and dreams and hopes and inspiration. In my lifetime, we have given the planet a world war, and hundreds of smaller conflicts. We have accumulated a legacy of a thousand polluted river ways and oceans that cough up garbage. We render new species extinct every year. We are systematically damaging the atmosphere and the land upon which we make our homes. We are consuming our seed corn.

If we are to leave a legacy that will endure, then we must begin to think about and save for a better future. We have to provide hope to the next generation that things may improve. And I can think of no realm, nor any pursuit, nor any frontier that offers as much hope and possibility as does the rich, vast, unrivaled splendor of space.

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